PARTIAL ENGLISH TRANSLATION OF JAPANESE LAID-OPEN
PATENT APPLICATION NO.2002-021773 (PART OF
PARAGRAPHS 0023-0024 & 0046-0047):

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[0023]
      ... As the first magnetic coupling.
abnormality detector 57 for monitoring the electric
magnet current, a circuit 100 as shown in Fig. 7,
10 for example, is suitable. Fig. 7 is a block diagram
showing an example of a circuit for detecting
impeller step-out (magnetic bearing coupling step-
out) used by the centrifugal liquid pump of the
present invention.
15 [0024]
      The circuit 100 monitors current values
such as I1, I2, and I3 of electric magnets (three
magnets according to the embodiment) that are
included by the centrifugal pump for magnetic
20 bearing. The current values are added by a first
operational amplifier. It is considered abnormal if
the total is less than a threshold value D
(specifically, if the output of a second operational
amplifier is H). Here, the magnetic coupling
25 abnormality detector is not limited to what is
described above; but may be configured such that it
is determined abnormal if any one of the current
values is less than a threshold value, or if two or
more values are less than a threshold value. Further,
30 it does not have to be an analog circuit as above;
but may be digitally configured. Further, the
information on which the abnormality determination
is made is not limited to the total of the current
values; but the information may be a total of the
35 current in a given period, an average for a given
period of the current value total, or an average of
the current in a given period. ...

[0046]

     ... Fig. 22 is a block diagram showing an example of the magnetic bearing abnormality (electric magnet current abnormality) detector used by the centrifugal liquid pump of the present invention.

[0047]

     This circuit 170 monitors current values (I1, I2, and I3) of the electric magnets (three according to the embodiment here) that the centrifugal pump includes for magnetic bearing. If the total of the current values is greater than a threshold value -C, it is determined abnormal. Specifically, the current values (I1, I2, and I3) are added by the first operational amplifier, and the total is compared with the threshold value -C by the second operational amplifier. If the output of the second operational amplifier (which outputs H if an input value is less than a threshold value) is L, it is determined to be abnormal. Here, the magnetic coupling abnormality detector is not limited to the circuit described above; but the abnormality can be detected by determining whether any one of the current values is greater than the threshold value, or two or more of the current values are greater than the threshold value. Further, it is not limited to an analog implementation, but a digital implementation is possible. Further, as for the current value serving as determining information used by the magnetic bearing current abnormality detector, a total value of the current in a given period, a total average of the current in a given period, and an average value of the current in a given period can be used. When the total average of the current in the given period is used, a digital process is used. If the average value of the current in the given period is used, an analog

implementation using a low pass filter, and a digital implementation are possible.